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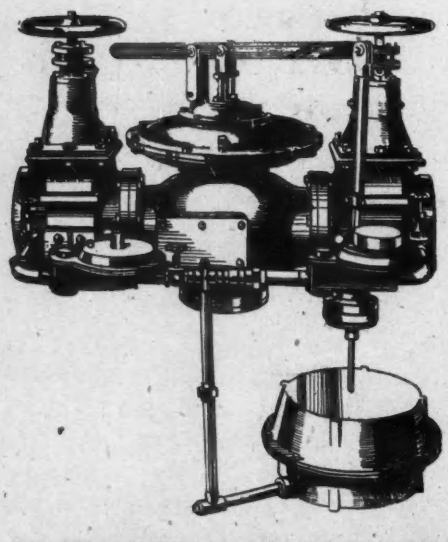

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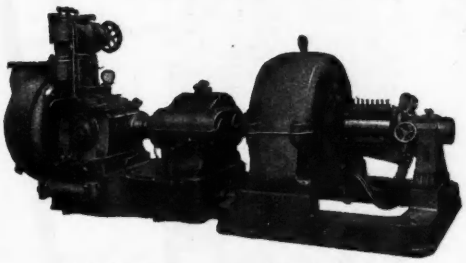

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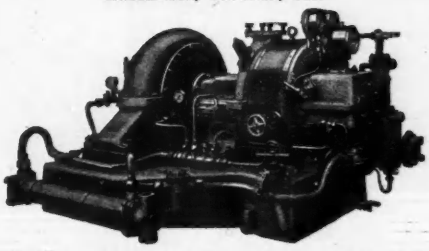

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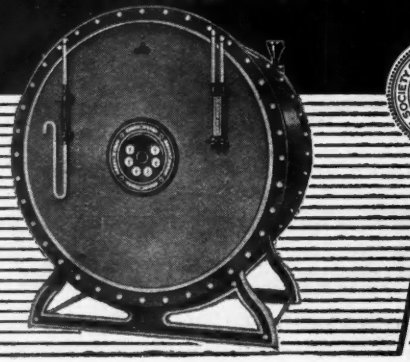

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GAS JOURNAL, FEB. 3, 1943

VOL. 241 95th YEAR No. 4159

EDITORIAL NOTES

EXAMINE THE OBVIOUS

ACTION not long delayed was foreshadowed in a vigorous and inspiring Address by Dr. E. W. Smith last Friday to the London and Southern District Junior Gas Association —action towards unity and cohesion in the Gas Industry, in which the Juniors of the Industry were encouraged to make their voices heard and to clarify their views and make them unmistakable. Our report of the Address—a talk eminently suitable for general broadcast to the Industry—will be found in to-day's "JOURNAL." It epitomized several phases of the activities of the Directorate of Gas Supply since its formation, stressing what may appear to be the obvious, but the emphasis of which has without question been recognized to be an obvious need. The dominant note was, we think, that having agreed on a common purpose, we must also agree to exercise a large measure of administrative common sense—administrative common sense aimed at effective cohesive effort of the director, the manager, the engineer, and the chemist. And Dr. Smith, in incisive manner, expressed his view that there is a good deal of dead wood in the Industry which will have to be cut away.

The larger undertakings have their problems and they have their opportunities for further improvement, but they do not constitute the major and immediate problem presented by the small and isolated unit inadequately financed and staffed to cope with current requirements and future demand. Dr. Smith quoted the Midlands—merely as example—where, in the area covered by the Gas Engineering Advisory Board serving it, 80% of the undertakings have no chemist, and whose check on calorific value, inerts, and fuel consumption is, to say the least, highly haphazard, and whose capabilities of coping with any new demand of substantial nature are slight and shaky. Yet it is on the working results of such undertakings and the service which they afford consumers—both domestic and industrial—that the Gas Industry as a whole is largely judged. It is a state of affairs which, said Dr. Smith, calls, not for tinkering and compromise, but for a new and broad conception of unity and co-ordination. There would, he hoped, be an impartial enquiry when evidence would be taken, recommendations made on it, and action taken on it; and in this matter of submitting evidence the "juniors" as well as the "seniors" had their part to play. In the meantime the internal working of individual undertakings should, from the technical angle, be tightened up, as it can obviously be tightened up, by attention to the obvious.

GASMAKING EFFICIENCY

ON a later page will be found the reply by Dr. Pexton to the discussion on his Paper, "The Fuel Requirements of Carbonizing Plant," publication of which extended over our January issues. This completes our full report of both Paper and discussion; but, as we have tried to indicate, it should be only the starting-point of much further study of the whole matter—study which we have good grounds for believing will result in action to the benefit of the Gas Industry. As we remarked, the discussion was of a standard in keeping with that of the contribution itself; and we think we might to useful purpose refer to one or two of the points which emerged. One speaker pictured a unit carbonizing 50,000 tons of coal a year. With a fuel consumption of 11%, 5,500 tons of fuel are used for heating. If the consumption is 20%, the fuel consumption is 10,000 tons a year. At present prices of coke this represents an additional expenditure of about £9,000 a year—and this on a comparatively small installation. It was added that attempts to justify such a state of affairs are often made on the grounds that the extra coke consumed is recovered as steam from the waste heat. But is this an efficient method of turning heat into steam? If a certain production of waste heat is unavoidable by all means turn it into steam, but do not let us go out of our way to make waste heat. If the steam produced is insufficient, raise the extra steam in independent boilers fired by coke breeze. We feel sure that lowering the producer fuel consumption—*i.e.*, reducing the quantity of good coke used—will ultimately go a long way towards solving the coke breeze problem.

Another contributor to the discussion spoke of the striking figures in the Paper (p. 84, "JOURNAL" of Jan. 20) showing that whereas the fully regenerative coke oven gives a fuel consumption of 10.8% of coke, the modern continuous vertical retort with no allowance for heat recovery from the waste gases gives a fuel consumption of 11.1%. And he went on to say: "Seeing that steam is required on all gas-works, it would appear that the true comparison should be between the fully regenerative coke oven and the continuous retort with waste heat recovery—that is to say, after crediting the latter with the surplus steam which can be produced from the waste gases leaving the setting." On which lines it can be calculated that the net fuel consumption of the continuous vertical retort is only 7.6%. But does not the basis of this comparison rather neglect the fact that waste heat steam is raised at a constant rate per hour throughout the day? In a previous comment on the Paper in the "JOURNAL" of Jan. 20 we mentioned the Author's figure of 70% as a gas-making efficiency possible of achievement in the not far distant future. This figure was brought out in Table I ("JOURNAL" of Jan. 6). Even so, some steam is being blown off at night-time. Hence is not the better approach to debit the carbonizing plant which does not produce waste heat steam with whatever fuel (incidentally, breeze) is required to raise the steam as and when required. In other words—and this was a dominant note of Dr. Pexton's Paper—treat the works as a whole. On which basis, had coke ovens been included in Table I to which we have referred, it would have been necessary to debit coke ovens with 1,000 lb. of steam, equivalent to 10 therms per ton of coal, in turn equivalent to 14.3 therms of breeze—or 1 cwt. of breeze per ton of coal. Following this reasoning we arrive at the figures of 3.18 cwt. of fuel (1.45 cwt. of coke and 1.73 cwt. of breeze) per ton of coal carbonized in coke ovens, and of 2.37 cwt. of fuel (2.22 cwt. of coke and 0.15 cwt. of breeze) per ton of coal carbonized in continuous vertical retorts. And we might remark that the burning of breeze does require special and larger boilers.

A further comment in the discussion which impressed us was this: "Although the decomposition of coal may be thermally neutral, it is apparent that it is an easier thermal job to make a therm of coal gas than it is to make a therm of water gas." In a previous note we have mentioned the deduction that in continuous verticals the sensible heat in the coke between 1,000° and 850°C. is capable of producing 12 therms of water gas without incurring extra fuel consumption, which tallies with the accepted view that the first 5% of steaming is very profitable, but that at higher degrees of steaming the water gas produced incurs at least as great a fuel expenditure per therm as does coal gas production. And we would now call attention to Dr. Pexton's suggestion that a possible method of usefully recovering the sensible heat from the coke from continuous vertical retorts lies in the admission of blue water gas, externally generated, at the base of the retorts. His other suggestions with the same object in view are that we should focus attention on the preheating of secondary and primary air and the re-circu-

lation of coal gas from the top of the retort to the base of the retort.

We have had a good deal to say on what seemed to us to be in the nature of high-lights in Dr. Pexton's notable Paper, but there is a point in Appendix 1 of the contribution to which we have not referred. It is what may be termed a "general" point, brought out as long ago as 1906. Early in our lessons at school most of us were told about the 1810 hypothesis of Avogadro—that equal volumes of all gases at the same temperature and pressure contain the same number of molecules, from which it follows that the weights of equal volumes of various gases at a standard temperature and pressure are proportional to their molecular weights. Thus, at 0°C. and 760 mm. 2 grammes of hydrogen or 32 grammes of oxygen occupy 22.42 litres. It was not, we think, generally explained that the same factor can be used for English units as in the metric system—that 2 oz. of hydrogen, and so on, occupy 22.42 cu.ft. at the same standard temperature and pressure—pointed out by an American scientist nearly 40 years ago. It would probably have saved headaches if the ounce-molecule had been popularized. To some this may seem a small matter, but it does show how desirable it is that we should be acquainted with the scientific literature of different countries year by year as that literature is published.

Personal

Many friends of Lieut.-Colonel T. C. WHIMSTER, who, in pre-war days, was well known in the North-Eastern Counties as a representative of the Parkinson Stove Company, Ltd., will be interested to learn that after having been reported as missing for nearly a year, he has now been listed as a prisoner of war. Lieut.-Colonel Whimster was granted a commission shortly after the outbreak of war and secured rapid promotion, eventually being posted to Malaya, where he was taken prisoner when the Japanese invaded that country.

Obituary

Dr. F. S. Sinnatt

The death occurred on Jan. 27 of Dr. F. S. SINNATT, C.B., M.B.E., F.R.S., Director of Fuel Research. Born in Jersey in 1880, Frank Sturdy Sinnatt moved to Manchester early in life. He graduated in chemistry at the Manchester College of Technology. It was here, as Assistant Lecturer in Chemistry, working under Sir William J. Pope on metallo-organic compounds, that he was drawn to the subject to which he devoted boundless energy to the end of his life—the study of coal in all its aspects. Soon he was organizing lectures on fuel and inspiring his students with enthusiasm for this new branch of technology, and it was not long before he was appointed Head of the Fuel Section in the College and Lecturer in Fuels in the University (1915). In this capacity he carried out and directed a variety of researches on coal and coal products which resulted in the publication of numerous scientific papers. During this period he still found the time and energy to join the Territorial Army in 1908. He went to France as a member of the Special Brigade, R.E., in the Great War, but to his great regret was forced to return to this country on medical grounds. Later he assumed command of the O.T.C. in the University.

Dr. Sinnatt was among the pioneers who realized the importance of carrying out a thoroughgoing survey of the nation's coal resources. In 1918 he participated in the formation of the Lancashire and Cheshire Coal Research Association, and became its first Director of Research. Within this Association were developed many of the methods of research which were to form the basis of the organization of the Fuel Research Coal Survey. Dr. Sinnatt's part in this work will always be remembered as one of his major achievements.

In 1924 he was appointed Assistant Director of Fuel Research and Superintendent of the Coal Survey. In 1931 he became Director. New avenues of research were opened up and pursued with vigour and success; the Coal Survey was firmly established and accepted as an essential adjunct to the mining industry; association with industry was fostered, and wherever possible results of research received practical application.

During all this time Dr. Sinnatt's devotion to his duties in the Fuel Research Organization did not deter him from playing a lively part in other scientific activities, and he was always keenly interested in the progress of the Gas Industry, believing firmly in its great potentialities. His work in the field of fuel technology did not pass without recognition. Manchester University conferred the degree of D.Sc. upon him, and in 1938 he was elected to the Fellowship of the Royal Society. He was awarded the M.B.E.(Mil.) for his services during the Great War, and later he received the C.B. (1935).

William Grant

Mr. WILLIAM GRANT, a Director and Secretary of Alder & Mackay, Ltd., and Secretary of the Kennoway and Largo Gas Company, died suddenly in an Edinburgh nursing home on Jan. 27, at the age of 65. The son of a banker in Elgin, Mr. Grant was educated at Elgin Academy and Edinburgh University, and afterwards practised as a solicitor before the Supreme Court as a partner of Warden & Grant, S.S.C. He married Miss Elizabeth W. G. Mackay, only child of the late Mr. Alexander Mackay, one of the original partners of Alder & Mackay, for which firm he acted as law agent. He was appointed Secretary in 1919, a Director in 1920, and acted as joint Managing Director from 1923 to 1938. He leaves a widow, a son (Mr. Alastair M. Grant, a Director of Alder & Mackay, Ltd.), and two married daughters (Kathleen, wife of Mr. Harold E. Bennet, London Managing Director and Deputy Chairman of the Company, and Sheila, whose husband, Major A. R. McLeod, is serving with H.M. Forces). Kind and courteous to all with whom he came in contact, Mr. Grant's sudden death will be keenly felt by his colleagues and the staffs of Alder & Mackay, Ltd. The funeral was at the Edinburgh Crematorium on Jan. 30.

1943 "Journal" Directory

The following changes should be noted in order to keep the Directory up to date:

Page 32. HAYWARDS HEATH. H. Orchard, *Act. S.*, *vice* A. E. Whitcher, now *MD*.
„ 44. MARKET RASEN. Prices, 14d.; 17d. sl.
„ 46. MARPLE. Prices 12.4d.* flat; Opt. 2-part 5.7d.*; 10.5d.-8.1d. i; 6.7d.–6.1 d. htg.; 12.4d. sl.
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„ ix. SCIENTIFIC & PROJECTIONS, LTD., Telephone Ealing 6721.

Letter to the Editor

DEAR SIR,—The current issue of *Picture Post* contains an article on a "Tripoli Oasis" and shows a photograph of "The Only Clock in Gadames." "Time is measured . . . by the number of times the watchman has to fill a copper pot, with a hole in the bottom, with water. . . . In two thousand years the life of Gadames hasn't changed. Time is still measured by running water through a hole in the base of a copper pot."

When I read this I thought at once how like we are to Gadames! That is a general idea of the method we employ to record the calorific value of gas. As long ago as 1916 the late Mr. John F. Simmance designed a recording calorimeter in which the water-flow was measured by the rate of discharge through an orifice under a given head. It was a pioneer instrument and did good service for its time. But, after all, this is 1943—21 years after Professor Boys declared that for water measurement for the purpose of recording calorimetry he "distrusted the operation of natural law" and wanted a positive measure. Yet the orifice method of water measurement for recording calorimetry is still adhered to in later recorders extensively used throughout the Gas Industry.

In 1920, with the passing of the Gas Regulation Act a demand went forth for a reliable, accurate, simple, and cheap recording calorimeter. A number of different types were offered and have been used ever since, but what is the true position after 20 years? I consider it is fairly summed up by Mr. J. R. Duggan in a Paper to the annual sectional meeting of the Australian Gas Institute, 1941, when he said that recording calorimeters "have proved disappointing." In my own Paper in the same year to the Scottish Junior Gas Association I had occasion to observe, "The Industry is to-day using apparatus which is out of date compared with modern potential standards."

We have—naturally—not heard anything of the Calorimeter Sub-Committee of The Institution of Gas Engineers for a long time, but I hope it will be re-convened after the war, and I hope the whole subject will be officially and thoroughly gone into, and I trust they will recommend that measurement of water flow by orifice discharge be considered as out of date for calorimetry as the clepsydra is for horology.

The principles which I enunciated in my 1941 Paper (for which the Society of British Gas Industries awarded a Silver Medal) are free and open to all manufacturers of calorimeters to use.

It seems to me an anachronism that the testing of C.V. by manual operation should be carried on at all, and I am of the view that a recording calorimeter can be produced whose results could be taken as final without the application of the "'fiddling' corrections" so described by Mr. R. G. Thin at a Scottish Junior Gas Association meeting in 1928.

15, Warrender Park Terrace,
Edinburgh, 9.
Jan. 25, 1943.

Yours faithfully,
WILLIAM MASTERTON.

Fuel Efficiency Training Scheme

One of the first decisions of the Fuel Efficiency Committee of the Ministry of Fuel and Power in September, 1941, was to establish a scheme of training for both management and boilerhouse staff, to cover not only steam raising, but also the operation of gas producers, furnaces, and the use of heat for process work. A small Education Sub-Committee was formed under the Chairmanship of Dr. R. J. Sarjant, and it was thought advisable before launching any scheme to consult certain leading fuel technologists and enlist their help in devising a syllabus for the guidance of lecturers. A comprehensive series of lectures was drawn up and the collaboration of the Board of Education was enlisted. It was decided to proceed with experimental courses of lectures for management staff and lectures supplemented by demonstrations for boilerhouse staff. Each lecture was to be followed by a discussion period, and the courses were to be free. The centres selected for this initial experiment were Manchester, Bolton, St. Helens, Birmingham, Coventry, Wolverhampton, and Stoke-on-Trent.

To assist the Divisional Coal Officers in making local arrangements and organizing the classes and demonstrations, Local Advisory Education Panels were set up at the regional centres. Thanks to the initiative of these Advisory Panels and to the energetic work of the Divisional Coal Officers, the response to the announcement of these courses at the experimental centres exceeded all expectations; for Manchester alone there were 447 applications for the Courses.

The courses commenced early in January, 1942, and one lecture per week was given over a period of some six or seven weeks. They were held during the afternoons in working hours, and the managements of the participating works collaborated readily by allowing their employees time off to attend the course and by paying their travelling expenses.

The success of the initial experiment confirmed that there was an urgent need for instruction of this nature, particularly to explain the use of low grade coals and fuels with which consumers were unfamiliar. It was decided accordingly to extend the scheme as rapidly as possible to other industrial centres, and some 28 colleges and universities were operating under the scheme by the end of April.

It was decided to repeat the series of lectures and demonstrations during the summer and autumn of 1942. At the same time a number of new training centres was arranged, bringing the total number of colleges and universities up to 62, and enrolments now total 9,307.

It is recognized that the present emergency series of lectures can do little more than arouse interest in fuel efficiency, and awaken a realization of the importance of the problems to be tackled. The syllabus was devised primarily to ease present conditions by facilitating the use of low-grade fuels, but at the same time it opens up a field for future training by stressing the immense scope of fuel technology. With this in mind it is hoped that the present scheme will have a far-reaching effect on future training in fuel technology.

The Committee does not feel, in having organized this emergency training scheme, that its task is by any means completed. It has been suggested that this scheme may well have far-reaching effects on long-term fuel education policy, and with this in mind the Sub-Committee has been devoting considerable attention to what might be termed the interim period between the emergency scheme and post-war comprehensive training in fuel technology. The Committee's investigations and plans may be grouped under the following headings: (*a*) Continuation of the present emergency scheme, (*b*) Fuel Efficiency Handbook, (*c*) intensive training courses, and (*d*) a permanent and central Staff College.

By the end of 1942, 24 colleges had operated the emergency series of lectures at least twice; there were 38 centres where the course has only been run once. There is still a number of areas where there is probably scope for a repetition of the original series of lectures, before considering more advanced training, and the present emergency scheme will continue to be operated where enrolments are still likely to be received.

The Fuel Efficiency Handbook will embrace the use of all fuels for industrial purposes. This Handbook will be issued at a nominal cost, and will be the basis of future training in fuel efficiency in any courses sponsored by the Ministry.

The present emergency scheme has usually spread the instruction over a period of between 6–12 weeks. The need has been expressed in certain directions for more intensive courses condensed into a period of about a week, and embracing practice on the actual operation of various types of steam-raising and steam-using plant. The Committee accordingly has under consideration the organizing of intensive courses of training in fuel efficiency occupying a full week, and embracing not only lectures and discussions, but also demonstrations of various types of plant, including the actual operation of such plant by students themselves.

As a logical development of the intensive training scheme noted above, there would appear to be considerable scope for the establishment of a permanent and central training college for educating lecturers, management staff, boilerhouse firemen, and post-graduate fuel technology students in practical fuel efficiency. A permanent installation of carefully selected and interchangeable plant not only for demonstrations but also for test purposes would meet a growing need for both instructional and research facilities.

It is considered that the call for qualified experts after the war will be greater than ever before.

Identification of Pipes in Buildings

As a result of representations made to the Institution that the scheme of identification laid down in the 1935 edition of B.S. 617, Identification of Pipes, Conduits, Ducts, and Cables in Buildings, was not easy of application, the Committee of the British Standards Institution responsible for its preparation have made a careful review of the comments received, and in consequence a new edition of the Specification has just been published.

A modified scheme, in which the identification letters are painted in a colour contrasting with the basic colour, on the pipe itself, has been substituted for the shaped metal discs required by the original scheme to be attached to the pipe. The basic colours for the different services remain the same, except in the case of some of the subdivisions of water—about which most comment was received.

The scheme is intended for application to all types of buildings, except chemical works, for which a special scheme (see B.S. 457, Identification of Chemical Pipe Lines) already exists. In the many schemes for post-war building this specification should prove of great use to those responsible for the planning of the various services required in such buildings. Copies may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, S.W. 1, price 2s. net.

Long Service

Long service on the part of individuals is the rule rather than the exception in the Gas Industry. Messrs. Clayton, Son & Co., Ltd., gasholder constructors, have a fine record in this respect. One of their employees, George Albert Savage, who has just retired after 52 years' service in the shops and on outside work, was one of a squad of three riveters who have just completed making their 1,000th boiler for the firm during their 30 years' association as a gang. His colleagues on that squad, Thomas Smith and Wilfred Hayton, have respectively 41 and 40 years' service and are still at work.

Forthcoming Meetings

A Meeting of the General Committee of the National Federation of Gas Coke Associations will be held on Feb. 9 at Gas Industry House at 11.15 a.m.

A Meeting of the Central Committee of the Federation of Gas Employers will be held at Gas Industry House on Feb. 9 at 11.30 a.m.

A Meeting of the Central Executive Board of the National Gas Council will be held at Gas Industry House on Feb. 9 at 2.15 p.m.

A Meeting of the National Joint Industrial Council for the Gas Industry will be held at Gas Industry House on Feb. 10 at 2.45 p.m.

The Annual General Meeting of the Midland Association of Gas Engineers and Managers will be held in Birmingham on Feb. 11 at 2.30 p.m.

Meetings of the London and Counties Coke Association will be held at Gas Industry House on Feb. 15 as follows: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m.

Dividend Announcements

Wandsworth and District Gas Company recommend the payment of dividends for the half-year ended Dec. 31, 1942, at the following rates: On the 4% Preference Stock, £2%; on the Consolidated Stock, £3% (both less income tax at 10s. in the £). This will make the payment of dividends for the whole of 1942 at the following rates: On the 4% Preference Stock, £4%; on the Consolidated Stock, £5%.

Woking District Gas Company recommend the payment of dividends for the half-year ended Dec. 31, 1942, at the following rates: On the "A" Ordinary Stock, £5 10s.%; on the "B" Ordinary Stock, £3 17s.%; on the "C" Preference Stock, £2 10s.%; on the 4% Preference Stock, £2% (all less income tax at 10s. in the £). This will make the payment of dividends for the whole of 1942 at the following rates: On the "A" Ordinary Stock, £11%; on the "B" Ordinary Stock, £7 14s.%; on the "C" Preference Stock, £5%; on the 4% Preference Stock, £4%.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

FUEL ECONOMY IN THE GAS INDUSTRY

Address by Dr. E. W. SMITH, C.B.E., Director-General of Gas Supply

DR. E. W. SMITH, Director-General of Gas Supply, gave a talk to the London and Southern District Junior Gas Association at Gas Industry House on Jan. 29 on "Fuel Economy in the Gas Industry," and discussed the economy campaign now being initiated by the Regional Gas Engineering Advisory Boards.

Dr. Smith said he was certain that there would be a radical change in the Industry within the next few years, and he hoped there would be a move within a matter of months which would indicate to the Industry that something radical was in hand. It would depend a great deal on the leadership of that side of the Industry represented by the Junior Associations, because like all moves of this kind in our type of country with the title "democratic," it was rarely that official quarters would take any action unless it met with the approval of the industries concerned. It was to be hoped that not only the 99% who were backing him up, but also the 1% who might have opinions of their own within the Industry, would also take a broad view and support what was likely to be put forward, whether it happened to appeal to them as being 100% desirable or not.

When he was in Cornwall earlier in the week a very definite step was taken which in his view was unique. The gas engineers who attended the meeting at which he spoke were so eager that nearly every one of them brought two of his directors, and consequently the decisions they came to were the decisions of the companies.

There was no body in the Industry that represented the owners. Those who attended meetings, those who were progressive, were irresponsibly progressive in a way, in that they had no authority to see through the things that they recommended; they depended on councils and boards of directors and the like to implement whatever they decided should be done, maybe on the advice of their engineers, but not necessarily so. Consequently it was a startling move on the part of Cornwall to bring not only directors, but in many cases also the town clerks to the meeting, so that they had a very satisfactory discussion. Advanced views were expressed as to what ought to be done. The problems in London and South-Eastern England were nothing like the problems that were to be faced in many other parts of the country. The country would tell them that London was not England, and what happened in the country areas had a greater bearing on the influence of the Industry as a whole than what happened in London. The best was always expected from London and Birmingham and the other big cities, so that anything he said to them that night related mainly to the country as a whole.

When he became Director of Gas Supply he was appointed to ensure continuity of gas supply for munition purposes and so on, and to advise the Minister on the future organization of the Industry. On continuity of gas supply the two problems were shortage of coal and shortage of plant, and the more serious problem was the shortage of plant. The main source of energy for munitions to-day, apart from motive power, was gas, and it would have been still more important if there had been more of it; consequently gas had had to be made in the form of producer gas in many places where there was not a sufficient supply of town gas. When they started the Heat Supplies Committee they had to study the gas requirements of all districts and they found there were definite shortages, and instead of going right out for new plant in a hurry they came to the conclusion that the way to solve the problem was to practise fuel economy. Mr. Ronca and he visited most munition industries, and came to the conclusion that there was no place in the country where some economy could not be achieved. Taking the country as a whole they felt the Industry ought to be ready if possible to make a saving of 20%, and in some places the savings were twice 20%. They started the idea of having what were known as "gas chasers" in big industrial concerns, men on the staffs of the concerns who were allocated to chasing gas, and they had been very successful.

The committee under Dr. Grumell and Dr. Macfarlane, of which Mr. Masterman was a member, approached the question of economy in a thorough and exhaustive way, believing that education of the individual was important, and that frequent reiteration at technical meetings was important; and the work they had done had been remarkable in its effects, and it covered a great deal more than gas. The outstanding fact that impressed itself on them was that economies could be effected without radical changes in furnace practice or in furnace design, and without having to bring in regiments of chemists testing draughts, CO_2, and taking temperatures. The main savings, it was found, could be got by administrative action, by normal common sense. One might, for example, take a works or a shop in which there might be 25 furnaces, consuming from 15,000 to 20,000 cu.ft. per hour each, and go through the shop and see furnace doors wide open when not in use, bad maintenance of fitments of doors, dampers and flues which were badly operated, air slides which were not used, or, if used, closed deliberately; big furnaces in which hundredweights instead of tons were being treated, and a larger number of furnaces being used than was necessary, and so on. In one works they declared that 40% of gas could be saved. In twelve months the output of that works was doubled and they were actually using less gas, a great deal more than 40% being saved. In a big glass works they found a long modern continuous bottle-annealing furnace in use, with a large number of small high-pressure flames, but there was bad attention to direction and insulation. As a result of common-sense economy the consumption was reduced from 12,000 to 3,500 cu.ft. per hour in normal operation.

If there was one main criticism against the Gas Industry in its industrial gas development it was, in his view, that too much attention had been given to the question of being able to reproduce results that had been got by other means, and too little attention to the question of how equipment could be so designed as to give the same results on a lower fuel consumption. There ought to be enough information among the industrial gas centres and the technical men of the undertakings to indicate the limits of consumption and to show definitely when it was too high. They were all up against the fact that the policy in the past had been how much gas they could sell, and not how much they could save. The attitude had been that the sales department on the industrial side had achieved good results when the percentage of industrial gas was creeping up, and they had not asked themselves what satisfaction they could give over and above what appeared to give satisfaction to the consumer who had taken on the load. They needed to develop a greater sense of service of the right kind; not just satisfying the consumer in getting results, but in watching his interests.

He was anxious that in the future there should be greater co-ordination of gas undertakings and merging of the interests of gas undertakings all over the country. That did not apply so much to London, because in London there was very close working. The area was congested and there was not much difficulty. He had in mind a huge area some 50 miles square with perhaps 20 gas undertakings a few miles apart, and not one of them big enough to give anything like the service it ought to be giving; not one of them with a staff that knew what its costings were.

He appealed to all chemists to develop a great deal more on the economic side of the Industry and to study the bearing of costs upon their work, the importance of costings in their work, and the evaluation of their own work from the cost point of view. A large number of small undertakings had no chemist at all, with perhaps one manager at £450–500 a year doing everything, plus a few workmen. Any new industrial demand might mean doubling the output. Only that day he had had a case of a small undertaking with three horizontal retorts which had been confronted with a new demand which would mean another three retorts. How could the Industry hope to carry on under such conditions? Poor quality products, coke that was not screened or dried, gas which ought to be of 450 B.Th.U., but which was nearer 350 B.Th.U.—because it was never tested—all contributed to the bad impression which some of the very small works created. He did not need to argue long that there was a necessity for a radical change in the Industry as a whole. It could not be done by tinkering or by compromise. There must be a new conception as to ownership and control and management of the Industry.

If there were to be an enquiry, as he hoped there might be, evidence would be taken from all parts of the Industry and from all the interests affected by the Industry, and based on that evidence recommendations would be made, or should be made, and he was hoping that if and when that time came, not only the senior bodies but the juniors would think it worth their while solidly to get down to things and make their recommendations.

One of the ways in which the Gas Industry could help in the near future, under war conditions, was in connexion with the economies that could be made in the gas undertakings themselves. There was a shortage of coal and a shortage of plant. Dr. Pexton had recently given that Association a remarkably fine Paper on the possibilities of economies in the future in carbonizing plant. He had read every word of the Paper and the discussion, and it was a most valuable contribution to the technique and education of all in the Industry. From the Paper they could deduce certain implications and inferences.

He hoped they would look thoroughly into everything with which they came into contact which consumed fuel within the Industry and study those factors which had a bearing on the consumption of coal. To whatever extent they could save coal, coke, or oil they would be making a real contribution to the present effort. He was fortunate in having an Advisory Committee consisting of Mr. Birks, Mr. Rhead, Mr. Cheetham, and Mr. Finlayson to help him to determine how to put these matters over. They would have read in the "GAS JOURNAL," and every gas undertaking would have received from him, a statement as to what they should try to do. They, as technical men, would probably be the first to criticize and say it was unscientific and it was not reasonable. They had found on going through all the returns from the country as a whole that the amount of fuel used in the process of gas manufacture, for the purpose of gas manufacture, whether in the form of water gas, coal gas, steam raising for water gas making, or oil, was about 26%; that was an average for the country as a whole. There were sure to be big anomalies and discrepancies,

but they were not big enough to vitiate the argument that if one got the figures into a column and saw very high ones, or very low ones, one should investigate them.

These figures—which they called the Fuel Consumption Index—were being supplied to each of the Regional Gas Engineering Advisory Boards, and they were asking them to study them and check them up, because the figures were based on returns made to his Department. The returns were wrong in many cases. Some figures had been left out, and the results needed checking up in each region. Some works would be working with high calorific values, and some with low, and some of the differences were remarkable, but they did not really seriously affect the comparisons.

The new committees that they had set up regionally were the beginnings of a remarkable development in looking at things within the Industry. What they were asking these committees to do was to look at the figures and sort them out and discuss them with those undertakings that showed particularly big figures, and offer assistance to those engineers who might need it. The Midland Panel, as it was called at one time, had done a great deal of that kind of work in the last twelve months. It was found that 80% of the undertakings in the district had no chemist. Most of them only checked their calorific value occasionally. Many of them had no official tests; he was covering all undertakings, whether statutory or not. It would be realized that they could not get very far if there was no one who could determine what was happening. In the Midlands he was glad to be able to say that they had decided to have a travelling laboratory, and a travelling laboratory van with a group of chemists and experienced operators who would go round at the request of the engineers and do a certain amount of checking and testing. They might test calorific values, gravities, inerts, and the like. A charge of so much per day would be made to the undertaking for the services of the chemists and their equipment. The Department was helping them, and they were hoping that in the next three or four months this would be regular practice in the Midlands. The Midlands were to be congratulated on their progressive attitude.

When they saw the differences in inerts all over the country they would realize the great possibilities if attention was given on the lines he was indicating, without interfering with output. It ought to be possible to save about a million tons of coal within the Industry while maintaining output and not interfering with the declared calorific value. It ought to be possible also to save something like 10,000 tons of oil.

How frequently, he wondered, did those in charge of water gas plants take their jets out and clean them, and make sure they were fit for use? He had no sympathy with those engineers who tried to burn their coke dust in producers. It was a means of putting the coke dust away with the ashes very largely, because the coke dust went through the producer more or less unconsumed, and often found its way into the flues, where it interfered with combustion and aeration. He believed a good deal ought to be done in connexion with producer practice. It might cost more in certain directions, but it would cost a lot less overall, and too much attention could not be paid, first of all to the working of the producer, and, secondly, to the aeration of the gases in the settings, the CO_2 content in the waste gases, and so forth.

It might be commented that much of what he had to say was obvious, but it was necessary to tabulate the obvious, and if everyone would check up on the obvious there would be an enormous advance. On the question of inerts, looking through the figures for the country as a whole one was astounded to see the large number of small works with nothing but horizontal retorts, in many cases with first class coals producing gas well below 450 B.Th.U. They knew, and he knew, that was not good practice.

They must face the fact that technically, taking the Industry as a whole, conditions could be improved. It was no use for London and other places to do well and to leave the rest of the Industry as it was. It was essential for those who were doing well to assume some responsibility for the Industry as a whole. What they wanted were better facilities, better scope, better opportunities of getting together.

Discussion

Mr. **F. M. Birks** (Gas Light & Coke Company) thought the real secret of economy lay in three points: (1) Attention to detail, (2) more attention to detail, and (3) still more attention to detail. One of the economies mentioned was in connexion with the boilers, and the point had been well brought out in Dr. Pexton's Paper. The question of the utilization of breeze was a subject that still had quite a lot of scope. He entirely endorsed Dr. Smith's opinion that the last place to put breeze was into the producer. He had been convinced for many years that the best place to put the breeze was in a properly designed boiler. In the future he hoped they were going to increase the overall efficiency of their carbonizing processes, which meant the efficiency of the works as a whole. In that event it was inevitable that the amount of waste heat steam available would be considerably less, and therefore they would have to raise steam from their own solid fuel. There was no question that one could practically get the same results, or very nearly the same results, from breeze that one could get from coke, and therefore they had obviously up-graded the value of breeze to the value of coke, which had not only increased the thermal efficiency of the works, but greatly affected the economic efficiency. He felt that the question of correlating costs and technical data needed attention. Their viewpoints were not always quite correct. One of his hobbies was to correlate savings of net coal instead of gross coal. They heard so much about therms per ton gross, but that did not affect the overall thermal efficiency of the gas-works so much as the actual gas made per ton of coal consumed in gas making—the coal left after one had taken away the coke, tar, and breeze from the gross coal. For many years they had talked of coal gas therms per gross ton, and about water gas therms per ton net. If they could get into the habit of calling them both "net," then fuel, producer gas, blue water gas, and coal gas would fall into line and give an overall over-riding efficiency which was practically the same for any calorific value gas. He regarded the fuel consumption index as a most valuable starting-point for overall efficiency in the gas-works.

The **President** (Mr. G. Dougill) heartily agreed with the view that they could increase efficiency without instruments, without anything beyond their own eyes, ears, noses, and their common sense. Although he might term himself a scientific gas engineer he was constantly telling people to use their common sense. He did not say instruments were not needed; they were a great help in every works, but common-sense observation was essential. During the war, despite short staffs, nearly everybody could spare someone to point up air leaks. He would like to support Dr. Smith's appeal not to expect a battery of research chemists always to be at hand, but to get down to the job themselves. Another useful point was to get all the technical people to realize that the only common denominator on which to base their results was the point mentioned by Mr. Birks, the correlation of the efficiencies of the gas-making processes.

Colonel **F. J. Bywater** suggested that the greatest enemy of the Gas Industry was within its own walls—the inefficient village gas-works. Conditions in some of the very small undertakings were inimicable to the general reputation of the Industry. Many of the holding companies had done extremely good work in wiping out and eliminating some of those defects, but there were still many to be dealt with, and he hoped Dr. Smith would not look in vain to the Gas Industry to support him in the work he had undertaken.

Mr. **E. A. Johnston** (South Metropolitan Gas Company) said that among many young men in the Industry there was the feeling that they were not really employed by the nominal owners of the Industry. In the mind of any technical man worth his salt there could not be a very close connexion between the work done and the remuneration received for it. In so far as any technical man thought about these things, he thought it was true to say that a large proportion of them did not regard themselves as being employed by the shareholders of the company. A high proportion of them regarded themselves as working for the consumers who, in the long run, paid their salaries; there was a spirit of public service. They felt that the people for whom they were working were having their inefficient fuel service provided by three or four industries, and for their expenditure got a small return in actual comfort and service, and who had not the funds, or the knowledge, or the initiative or freedom to break away from conventional practice and to start again. They hoped to do something for them, to make their homes more comfortable, cleaner, easier, and freer from drudgery. Dr. Smith had spoken of possible changes in ownership and organization, and he would like him to be encouraged by knowing that many of the younger people were feeling that way now. When the enquiry to which he had referred was held he thought there would be many who would not be backward in giving evidence.

Dr. **G. W. Anderson** (Gas Light & Coke Company) said the points that appealed to him were concerned with the power development on the gas-works. He had worked out the fuel consumption for power purposes on various works, and much to his amazement they ranged from 3 to 10% of the coal carbonized. He felt that if one looked into the possibilities of further economies in that respect, one would find that by employing large power units to start with one would reduce very considerably the fuel consumption in that sphere. Dr. Pexton's Paper, excellent though it was, had not touched on that point, and little work was in progress that would show the lines on which to proceed.

Dr. **Smith,** replying to the discussion, said the Gas Industry was not peculiar in the fact that it rarely knew how to use its staffs. There was nothing like co-operation and team work. How rarely was the chemist asked to give advice on the results of his analyses. It was a case of putting a penny in a slot, taking the analysis that came out, and leaving somebody else to interpret it. How rarely, when things went wrong, was there a staff meeting, with the people primarily interested, including the retort house foreman, the chemist, the operator, and the like. They could not bring up a staff to run the Gas Industry unless the people at the top knew how to manage and treat staff. For how many years had they all agreed that sulphur should be eliminated from the gas? But nothing had been done. If they took it out it would have enormous repercussions on the value of the Industry. There was nothing more important to-day than the practical elimination of sulphur, and yet because of the methods of organization, because of the lack of cohesion, lack of funds, things like that were not done.

For every ton of coal they used in the Industry they had on the average half a ton of coke that was available for sale. Their main product was coke, not gas; the greatest weight was coke, and they must tackle the question of activating their coke. If the coke were

activated and would burn more readily as a domestic coke there would be no place for coal.

They ought to feel they were fortunate in being connected with an Industry which had such infinite possibilities. They should see those opportunities and develop them, and he believed that in future the Juniors would be given more encouragement.

Mr. **F. C. Smith** (Gas Light & Coke Company), seconding a vote of thanks briefly proposed by the President, said that compared with the electrical industry the Gas Industry was an old one, and some of the things which Dr. Smith had rightly been deploring were the result of the age of the Industry. It was now time to take stock and to cut away the things which were not progressive. When amalgamations occurred they should aim at one object—that of giving cheap and good fuel to the masses and to industry. Referring to industrial gas, Dr. Smith had said that the aim of those who had been responsible for the development of industrial gas had been up to the present to be able to give the same results with gas as had been obtained in other ways. He would like to add to that and say that the value of the product was so great in relation to the price of fuel that fuel had been a matter of secondary importance. That was a fallacy that had been gaining ground. In the future they must do all they could to ensure a maximum of efficiency in the works. They must make sure that when they had got their valuable B.Th.U. on to the district they were used to the best effect.

FUEL ECONOMY IN GAS WORKS

No. 2

We are indebted to the Severn Valley Gas Corporation, Ltd., and Gas Consolidation, Ltd., for permission to reprint a series of notes specially compiled for them by G. M. Gill.

Efficient Operation of Producers

IT is important to work a producer in such a way that it makes the same quantity of producer gas all the time, so that the secondary air used, which after regulation remains unchanged except for variations due to changes in the chimney draught, is sufficient to burn the producer gas efficiently. It is considered good working to regulate the secondary air in such a way that it consumes all the producer gas with a small excess of air.

It should always be borne in mind that a producer must be filled often enough to maintain a sufficient depth of hot coke; otherwise it will not work properly as a producer, which type of furnace *must* have a sufficient depth of fuel. If the depth of fuel is insufficient, the air passing in at the bottom will not be converted to carbon monoxide gas, but will instead be converted to carbon dioxide gas, which, of course, is merely a waste gas.

The minimum permissible depth of fuel in a producer is about 3 ft.; under that depth a proper quality of producer gas will not be made. Accordingly, it is important to decide upon the intervals when the producer should be filled and then to keep strictly to such periods. The heating of many retort houses is spoilt by failure to fill the producers often enough; and this is especially noticeable where the producers are shallow in depth, as the minimum of 3 ft. in depth of fuel is soon reached in the case of shallow ones and in those in which, due to their shape, the coke can only be pushed with difficulty to the back of the furnace.

There are, too, a good many cases where the efficiency of the operation of the producers is greatly decreased by the practice of working retort houses with two instead of three shifts, which frequently results in insufficient filling.

Clinkering

Regular attention should be given to the clinkering of the producers, which it is assumed have step grates or sloping bar grates. A good fireman will remove the clinker and the ashes with a minimum of coke. Both care and skill are required, but it takes time to train a man to do this work well.

Producers should not be clinkered too often or too infrequently. It is a question of gauging the correct time for the different types of coke used. It is a mistake to disturb a fire which is in good trim and working well. In such cases it is sufficient to try it with the pricker bar and make sure that no clinker is attached to the sides of the producer. In both types of grates the clinker is cut away from the side walls, the pieces being then allowed to find their way into the ashpit, from which the clinker is removed when the producer is again opened up for cleaning.

It is, of course, a bad plan to allow producers to go too long before cleaning. The work is then much more difficult, the operation of the producer having been disturbed and rendered inefficient, with the result that fuel is wasted and much more good coke has to be pulled out with the pan breeze.

It is obvious that if the producer is dirty with accumulations of clinker, the air will not find its way freely through the fuel bed, and as a consequence the amount of producer gas made will be reduced. There will then be too little producer gas in proportion to the secondary air used, with the result that a quantity of secondary air with no work to do will merely pass through the setting and cool it down.

Quality of Producer Gas

Many producers are not worked to the best advantage, partly because tests are not made of the composition of the producer gas. It is impossible to have a retort house working really well unless the producers are doing their work efficiently.

Given a sufficiently deep layer of fuel at all points where the primary air can find its way through the fuel bed, and given a sufficiently high temperature, there should be no difficulty in making a good quality of producer gas.

What is a good quality of producer gas? This can be specified as follows:

25% to 30% Carbon Monoxide,
8% to 12% Hydrogen,
4% to 8% Carbon Dioxide,
and the remainder Nitrogen.

Given a sufficient depth of fuel and temperature of the fuel bed, the necessary reactions will take place to convert the carbon in the coke, first to CO_2 and then to CO, and to convert the water supplied to the grate first to steam, and then the steam and coke to form hydrogen and CO. Thus:

$$C + O_2 = CO_2, \text{ and then}$$
$$CO_2 + C = 2CO,$$
$$\text{also } C + H_2O \text{ (steam)} = CO + H_2.$$

Producers must be kept clear of clinker and ash so that air can penetrate the fuel bed in sufficient quantity. Obviously there must be sufficient draught on the producer or insufficient air will be pulled in. Accordingly, the damper regulations must be correct, as must also be the primary air slides. Clinkering doors must be tight, or primary air regulation will be out of control. Further, producer charging doors must be tight, or air will get in and burn some of the producer gas under the combustion arch if there is a vacuum at this point; or if there is a pressure some of the producer gas will burn round the door, which will soon be spoilt, while the producer gas will be lost and correspondingly more will have to be made, resulting in a waste of fuel.

Incidentally it is much better practice for producers to be worked in such a way that there is at least a slight pressure at the top of producers, as it is bad practice to draw air into producers when the producer charging doors are open or if these doors are leaky.

If producer gas burns round the charging door this will soon have to be replaced. This will entail shutting down the setting to carry out the repair, and consequently another setting has to be available to take its place.

Use of Water in Producers

Water has three uses in producers:

(*a*) For cooling the firebars.

(*b*) For cooling the bottom of the fuel bed and so reducing the tendency for the ash in the fuel to be fused into clinker; instead it will stay as "ash" and be easily removed.

(*c*) For making hydrogen gas and so enriching the producer gas.

To obtain the best use from water it is of great importance to ensure that a regular quantity per minute is admitted to each furnace, remembering that the working of the furnace is disturbed whenever the flow of water is altered.

The water should be allowed to flow from a tank through a definite size of hole to the distribution trough. By this means there is always virtually the same pressure and the same quantity flowing per minute into each furnace. Alternatively, a carefully regulated quantity of town or other clean water can be admitted to each producer through a definite size of orifice, the water being passed through a governor set to give a pre-determined pressure whereby the quantity of water passing into each producer is controlled to the required amount as stated below. Obviously, one governor will serve a considerable number of producers.

One further means of supplying water to producers is to pass the through an atomizer fixed to spray a fine mist of water upon step or sloping bar grates. In this case also the water must be clean and be governed to a definite and suitable pressure, so that the required mist

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NOMOGRAM No. 6

FLOW OF STEAM IN PIPES

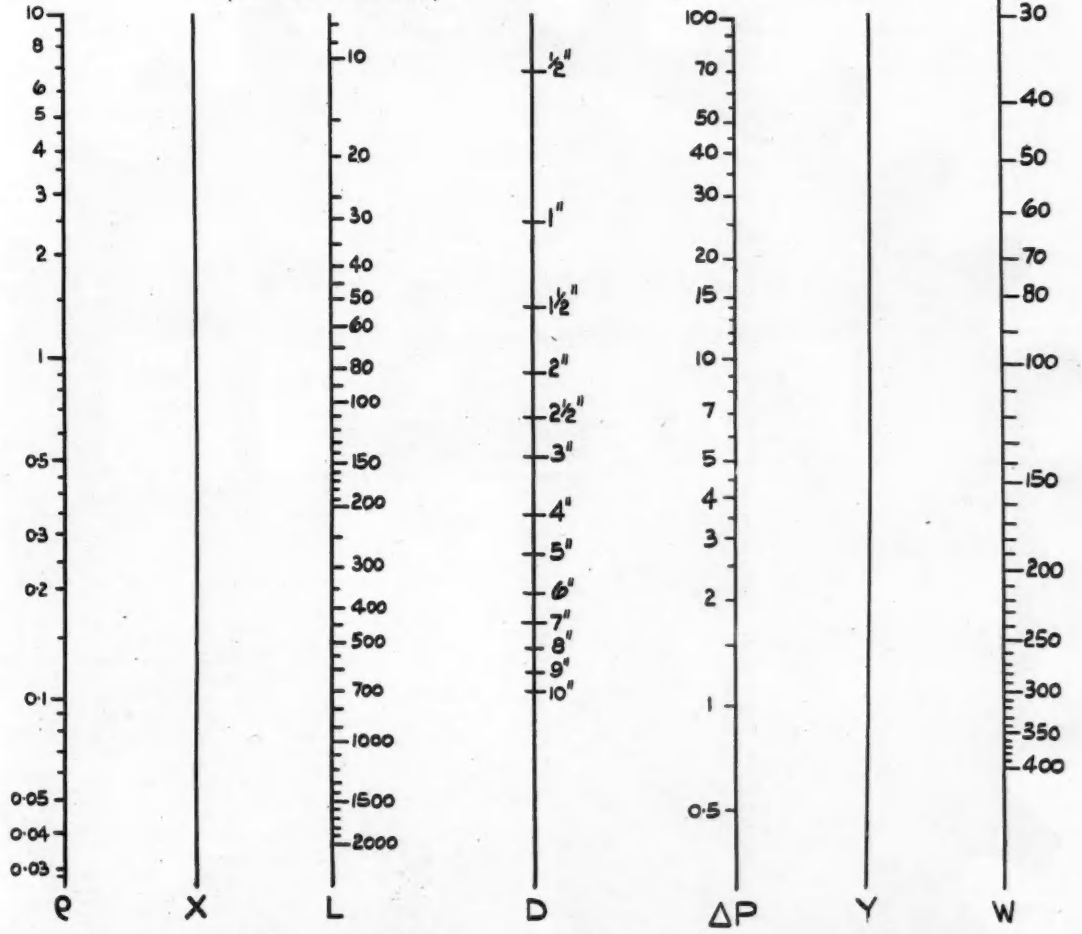
BABCOCK'S FORMULA.

$$\Delta P = 0{\cdot}000131\left(\frac{D+3{\cdot}6}{D^6}\right)\frac{W^2L}{\varrho}$$

Where ΔP = Drop in pressure in lbs. per sq. in.
D = Diameter of pipe in inches
W = Weight of steam flowing in lbs./minute
L = Length of pipe in feet
ϱ = Mean density of steam—Average density at entrance and exit of pipe (found from steam tables)

To find ΔP draw straight lines from
(1) ϱ — X — L to obtain X
(2) X — D — Y „ Y
(3) W — Y — ΔP „ ΔP

To find D draw straight lines from
(1) ϱ — X — L to obtain X
(2) ΔP — Y — W „ Y
(3) X — D — Y „ D



USE OF NOMOGRAM.

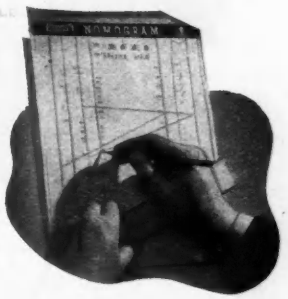
Suppose the diameter of pipe is required to pass 300 lbs. steam per minute (W), mean density $\varrho = 2$, length of pipe (L) = 800 feet and pressure loss $\Delta P = 1{\cdot}5$ lbs.

(1) (ϱ — X — L) Draw straight line from 2 on Scale ϱ to 800 on Scale L to intersect Scale X.

(2) (ΔP — Y — W) Draw straight line from 1·5 on Scale ΔP to 300 on Scale W to intersect Scale Y.

(3) (X — D — Y) Draw straight line from point of intersection of Scale X to point of intersection of Scale Y.

This intersects Scale D at a point between 5 and 6. Thus a 6" pipe is required.



W.D.

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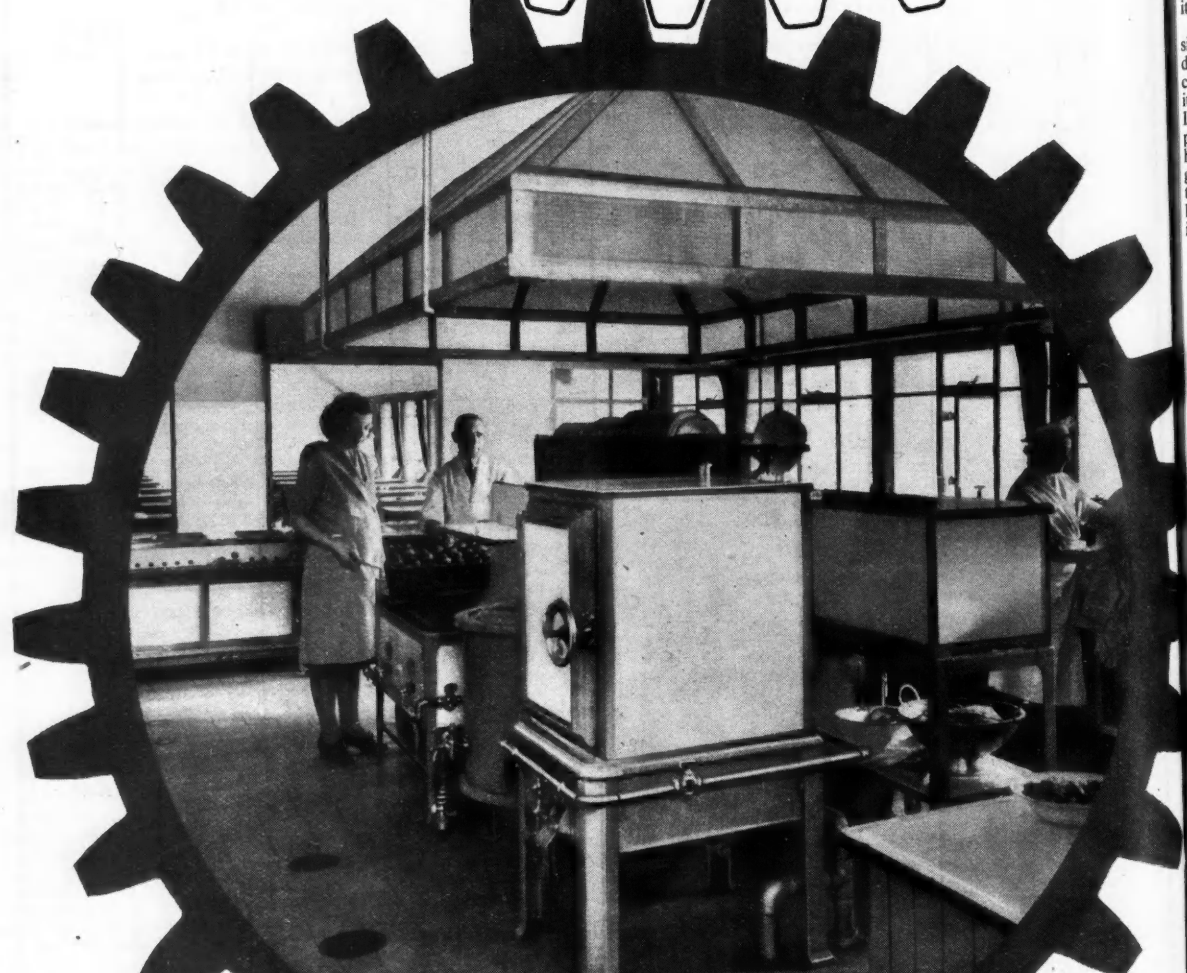
Radiation



is produced, and the required quantity of water is supplied to the grate.

The quantity of water used should also bear a definite relationship to the quantity of coke burnt. For producers there should be from $\frac{3}{10}$ to $\frac{7}{10}$ of a lb. of water evaporated per lb. of coke burnt; the deeper and hotter the fuel bed, the greater the amount of water used. This will keep the bars cool, and will prevent the bottom of the fuel bed from getting too hot and so turning much of the ash into clinker, while the whole of the water will also be converted into hydrogen, carbon monoxide, and carbon dioxide in its passage through the fuel bed. Thus the water performs a most useful function; but for some unaccountable reason its use and control in retort producers is usually sadly neglected. Actually, it always pays handsomely to give serious attention to this matter.

The amount of water used should never be so much that it accumulates in the ash pan. It is far better to work with virtually dry ash pans at all times. To have a lot of water in the ash pans serves no useful purpose. Besides, with dry ash pans the pan breeze pulled out is dry; and if this is picked clean from clinkers and screened from ashes, the resulting pan coke provides a much better boiler fuel than it would be if it were wet.

Frequently one sees water running into the producer grates and a similar quantity running out through the ashpit overflow. This is due to too great a quantity being used, and a complete lack of appreciation of the proper method. From what has already been explained it will be realized that control of water to producers is highly important. If the correct quantity of water is used and all is evaporated, then the producer gas will be of higher heating value, for it will contain more hydrogen gas and a somewhat higher quantity of carbon monoxide gas, and these conditions will be uniform. On the other hand, if too much water is being used and the ashpit is overflowing then very little of the water will be evaporated, as it will remain too cool and so it will not be converted into H_2 and CO.

Clinkering and Charging Doors

In the modern types of settings the primary air slides are usually fitted in the clinkering doors. It is important to ensure that these doors are well fitted, machined on both faces, and are kept clean and air-tight. This being so, it is essential that the top and bottom catches of the doors should be used at all times; otherwise the doors will not be tight, and air will enter through the doors as well as through the primary air slide openings. In other words, the primary air will no longer be regulated, but will be admitted in a haphazard manner and so disturb the working of the setting. Further, if either the top or bottom catch is regularly left slack, it will not be long before the doors become warped and then it will no longer be possible to keep these tight.

Charging doors should be large enough to permit of the coke being fed quickly and without difficulty into the producers; and when the producer has been filled, these should be tightly closed and kept as tight as possible. If they become warped or cracked they should be replaced. It is very bad practice to allow air to enter the top of the producer at this point, as it will burn the producer gas under the producer arch, and generate great heat in a part of the setting which is not designed to withstand it. Further, such air will be doing the work of the secondary air, all of which should be admitted only in the combustion chamber. As a consequence there will be too much secondary air, which in its turn will cool the setting.

On the other hand, if, as is often the case, there is a pressure in the producer, then producer gas will leak through any producer charging door that is not tight, and will light up and speedily damage the door, while the producer gas itself will be wasted.

Pan Breeze

One method of bringing about fuel economy is to provide that good fuel is not sent away with the pan breeze. For the larger works, machines for separating the coke from the clinkers can prove a good investment, but it would probably be difficult or impossible to purchase a machine of this type to-day. The work of separation can be simplified by using a mechanically-driven screen to divide the pan breeze into sizes, of which the smallest, below, say, $\frac{1}{2}$ in., is virtually worthless. The sized material from $\frac{1}{2}$ in. to $1\frac{1}{4}$ in. is too small to hand-pick, but can be used as an inferior boiler fuel in cases where the boiler or boiler plant is well above its capacity.

The material above $1\frac{1}{4}$ in. can be hand-picked free of clinkers, as the result of which it can be classed as a medium-grade boiler fuel, and quite good enough for the majority of gas-works boiler plants.

Even quite small works can with advantage be equipped with a shaker screen fitted with two sizes in the screen to divide the material into three sizes in all, a barrow being placed to collect each size. The largest falls over the end into a barrow, from which the clinkers are hand-picked. The material is fed by shovel to the screen, which is about 4 ft. from the ground. It is a two-handed job, one shovelling and one hand-picking, both sharing the barrowing. It is most wasteful to use unsorted pan breeze for making up roads and for similar purposes. It is surprising how often one can see large quantities of good pan coke used for this purpose.

FUEL REQUIREMENTS OF CARBONIZING PLANT*

Dr. Pexton's Reply to the Discussion (see last week's "JOURNAL").

Mr. Finlayson rightly points out that the fuel consumption expressed as a percentage of the weight of coal decreases when the degree of steaming the retorts is decreased. A more satisfactory measure for fuel consumption, at least for the same class of coal, is *therms of fuel per therm of gas made*. For example, the following study of results by the Fuel Research Board expressed in this way shows how the fuel requirements of the process are increased by steaming in excess of 5%.

FUEL RESEARCH BOARD'S RESULTS† FOR STEAMING CONTINUOUS VERTICAL RETORTS (MITCHELL MAIN NUTS) (Beilby, *Trans. Inst. Gas Eng.*, 1920–21, 356–470).

Heat input to combustion chamber—Y—(therms per therm of gas made).

C.V. of gas	544	517	477	460	432
Y—for constant coal throughput	0.56	0.41	0.415	0.43	0.43
Y—for constant thermal output of gas per retort		0.41‡	0.435‡	0.45‡	0.46‡

Mr. Gaskill's points are more fully dealt with in the written version of the Paper.

Dr. Haffner draws attention to the use of high pressure boilers in central producer plants, which is certainly a step in the right direction.

Heat exchange between cold clean producer gas and hot dirty producer gas would not help, because the preheated producer gas would then not be so effective in the recovery of heat from waste gas or coke.

The results quoted by Dr. Haffner for the regenerative continuous vertical retorts at Rome are very interesting and are accounted for, on the basis of the present Paper, as follows:

	Therms per ton of coal.
Sensible heat in coal gas	3.5
Radiation losses (as for intermittent vertical retorts)	5.6
Sensible heat in hot coke (not cooled by secondary air)	9.0
Total	18.1

Overall heating efficiency 0.645.

Fuel required = 18.1 ÷ 0.645 = 28 therms per ton of coal or 9.5% dry coke (10% ash) per ton raw coal.

This type of installation relies entirely upon heat recovery from waste gases and neglects the heat lost in the coke.

Dr. Haffner doubts whether the endothermicity of the water gas reaction can be regarded as a useful heat recovery agent, and yet he hopes to utilize this very agency in semi-intermittent systems. I think that the point he wishes to make is that at higher degrees of steaming than I have considered, and when the throughput of coal has to be restricted to permit of the steaming reaction, then the endothermicity of the water gas reaction involves extra fuel consumption—a point with which I entirely agree.

Also, in the particular results to which the Paper refers, coal gas leakages into the combustion chamber were extremely small.

Mr. Muir-Wilson and Dr. Anderson refer to the very valuable feature of the South Metropolitan non-recuperative settings, in which the waste gases *en route* to the stack are brought to the front and back of the settings so as to "insulate" the setting with hot waste gas.

Dr. Weston has drawn attention to the very large increase in the gasmaking capacity of a continuous vertical retort carbonizing non-swelling briquettes and also to the large reduction in fuel consumption. Dr. Weston's figures relative to the fuel consumption of a modern installation of continuous vertical retorts carbonizing Yorkshire coal will have widespread interest.

The following hourly analyses of producer gas, between fire cleanings, illustrate Mr. Calvert's point regarding the unsteady conditions often met with in producers. In the first series, the ash pit was full of water and the fire was cleaned every eight hours.

* The Paper was published in the "JOURNAL" of Jan. 6, 13, and 20.
† Results adjusted by halving radiation losses.
‡ Calculated results.

Add up the Lost Hours

HOW many wagons, or lorries, or canal-boats have come to you in the last month for loading or unloading? How many unnecessary hours have they remained *standing still* at your wharf, your loading bay?

For those hours they were no longer in the transport system of the nation.

Could you have saved any of that time—got the vehicles on the move again a little sooner? Ten minutes saved in each hour of standstill time would give an immense impetus to our war transport all over the country. What can you do about it?

You know your own problems best. Tackle them in your own way.—But tackle them now. Plan, encourage ideas, improvise if needs be.

Here's a starting-off agenda:

1. CHECK OFFICE ARRANGEMENTS
2. LABOUR-SAVING EQUIPMENT
3. BLACK-OUT WORKING
4. OPINIONS OF "MEN WHO DO THE WORK"

WE MUST GET AN EVEN QUICKER TURNROUND

Ministry of War Transport

12

Hours after cleaning.	CO_2.	CO.	H_2%.
0.5	11.5	18.2	11.1
1.5	10.4	19.0	9.6
2.5	8.3	22.3	9.1
3.5	6.3	26.2	6.8
4.5	3.5	30.7	6.5
5.5	2.8	29.8	4.2
6.5	2.0	30.1	6.1
7.5	2.1	29.8	6.4

The second series refers to the same producer with restricted flow of water to the bars and with a *dry* ash-pit. The fire was clinkered every four hours and poked every two hours.

Hours after cleaning.	CO_2.	CO.	H_2%.
0.5	4.0	28.4	6.3
1.5	4.4	28.0	5.9
2.5	1.9	30.5	4.8
3.5	3.0	30.0	5.9
0.5	1.4	31.6	6.1
1.5	2.2	31.3	6.8

The major disturbing influence in the first of these two series was the excessive humidity of the primary air after fire cleaning.

Mr. Thorman asks for comment upon the dry cooling of coke from ovens and intermittent vertical retorts. It is a necessary method of "cutting one's losses" and is likely to be further developed. It is well to remember, however, that heat recovered as latent heat of steam is only recoverable in a condensing system—*i.e.*, in a low temperature operation—and is therefore not applicable to reduction in the fuel requirements of the carbonizing plant.

The results quoted by Mr. Owen are confirmatory of much that has been said in the Paper.

In conclusion, I should like to focus attention upon some of the possible methods of usefully recovering the sensible heat from the coke from continuous vertical retorts:

(*a*) Secondary air pre-heating.
(*b*) Primary air pre-heating.
(*c*) Admission of blue water gas, externally generated, to the base of the retorts; and—
(*d*) Re-circulation of coal gas from the top of the retort to the base of the retort.

FUTURE GAS-WORKS POLICY

Discussion on David L. Dickson's Paper (see last week's "JOURNAL")

Mr. **S. G. Melville** (Edinburgh, President of the Eastern District) gave figures about electricity generation efficiencies. He thought the limit obtainable was in the region of 30%, but in practice reached little more than 25%. This was a valuable point in favour of the Gas Industry. He agreed with Mr. Dickson that calorific values of 425–475 B.Th.U. per cu.ft. were good for vertical retorts. He himself had found difficulty in maintaining a C.V. of 500.

Mr. **J. Fulton** (Paisley, Vice-President of the Western District) agreed that coke disposal was of importance to the Gas Industry, but could not agree with the Author when he suggested that the type of carbonizing plant to be used in the future would be decided by the quality of coke to be produced. He noted that the installation of "continuous intermittent" vertical retorts referred to by Mr. Dickson was selected as one yielding coke and gas of similar qualities to the coke and gas obtained from horizontal retorts. He asked if Mr. Dickson would tell him why he had not included comments of the horizontal system in his Paper. He felt that a good deal of benefit could accrue to the Gas Industry by adjacent undertakings "getting together" on matters of policy particularly affected by local conditions. He believed it would be profitable to discuss the questions of gas and coke quality and marketing; methods of charging for appliances; sales and propaganda; &c., and their co-ordination in districts.

Mr. **E. G. Smith** (Dumbarton) suggested that coke-oven supplies, if obtainable at the correct price and of suitable quality, should be accepted by the Gas Industry whether or not it meant centralization. The deciding factor must always be, Will the consumer benefit?

Mr. **W. M. Gledhill** (Stirling), referring to the economic utilization of our fuel resources, said that post-war competition from fuel oil would require to be taken into consideration. He agreed that a standard specification for the installation of adequate gas services in relation to maximum demand was essential. Efficient gas appliances of pleasing design should be installed as an integral part of post-war dwellings, and with sulphur-free gas a bright future existed for flueless heating systems. With regard to the provision of skilled personnel, he was of the opinion that it was the responsibility of the Gas Industry to train such men without delay.

Mr. **A. P. McInnes** (Dumbarton) agreed with Mr. Dickson on the importance of the gas salesman in the future Gas Industry, but was afraid that his suggestion of one salesman for a number of small undertakings was hardly practical. However, there was nothing to prevent even the smallest undertaking utilizing a fitter or meter surveyor as a part-time salesman. It would be a definite advantage to the smaller undertakings if a fully trained industrial gas salesman was made available to them when required.

Mr. **Denoon** (Edinburgh) considered coke very important in post-war planning, and that quality must be standardized before good results could be attained in ordinary grates.

Mr. **H. Firth** (Cambuslang) was of opinion that distribution and salesmanship should not be under separate headings, but under one direction. He had experience of electric cooker users doing most of their water heating by gas and complaining as to the amounts charged on the respective accounts—forgetting the fact that probably 90% of the heat used was supplied by gas.

Mr. **Livingstone** (Perth) said that sulphur must be removed from the gas and the inerts kept as low as possible. Specific gravity and quality must also be kept standard. In his opinion trouble would be experienced in maintaining future quality of benzole extracted, unless the quality of coal was improved. Regarding training of staffs, the undertakings themselves must take responsibility for their own men if the Industry on a whole did not attend to this matter.

Mr. **W. Kirk** (Motherwell) would have liked to hear more on systematic education of juniors for managerial posts. He asked Mr. Dickson what he thought was the most economic calorific value which should be supplied by the Industry. He thought salesmanship was essential. He did not agree with many points of the B.C.G.A., and thought that if they had an organization on the same lines as the Electrical Development Association it would be to their advantage. Concluding, Mr. Kirk asked Mr. Dickson how he would price appliances in a municipal undertaking as against prices in a private company.

Mr. **A. Shand** (Falkirk, President of the Western District) dealt briefly with the subject of standardization of appliances, and agreed that salesmanship and distribution must be under one control.

Mr. **Dickson,** replying to the discussion, said there would be difficulty in getting the layman to think in terms of efficiency and conservation of fuel, but surely the powers that be who realized the need for conservation could enforce their views. He had tried to show that it would be necessary for them in considering the utilization of coal to consider it from a thermal viewpoint rather than from a weight or price per ton viewpoint. In doing so he stressed the coke oven balanced plant because he thought this type of plant was not well known. The chief reason for his omitting horizontal retorts was that the efficiency of this type of unit (again from a thermal viewpoint) was generally not so high as that of continuous verticals or intermittent vertical chambers, and in small or medium sized undertakings it might not be deemed advisable to install a Sulzer plant to recover the heat in the hot coke discharged. Undoubtedly if coke oven gas was available in surplus quantities it was up to them in the national interest to buy it, but he adhered to his original statement that only where it could be proved that the gas had been made surplus to the immediate requirements of the coke and steel industry proper within that neighbourhood, and not made for the sake of coke competitive sales, &c., should it be made available for sale, especially since this type of plant was not thermally as efficient as gas-producing plant. He agreed that in the post-war period they could expect intense competition from fuel oil unless steps were taken by the appropriate authorities to tax it at source and encourage the use of home-produced fuels.

Mr. McInnes had suggested that the meter surveyor or fitter could be used as a part-time salesman. This might be useful, but by so doing they departed from the practice of encouraging trained salesmen. The arrangement of a co-operative scheme of, say, one salesman for a number of works was, he thought, better practice and should be considered by the smaller undertakings, who might individually find it an economic strain to employ a man. He agreed that a specification regarding the quality of coke and sizing of grades was essential for post-war planning if success was to be attained. Undoubtedly, as Mr. Firth suggested, salesmanship and distribution could not be divorced. With regard to the training of staffs and employees, he thought the Institution should give a strong lead by setting up a curriculum to deal with salesmanship and industrial gas service of all kinds of heat treatment and central heating. Too much knowledge on those subjects could not be amassed. Mr. Kirk had asked the question, "What is the most economic calorific value which should be applied to the Gas Industry?" Consideration must be given to the coals in a particular area, and the value for that area determined by the best means of carbonization which would give the highest all-in thermal efficiency. Naturally this would require some research and it would not do to give at this time any arbitrary opinion. Mr. Kirk seemed to suggest there might be some difficulty in pricing appliances for sale or hire purchase in any area where company and corporation were in close proximity. He did not think this need be so. The impression he had gained was that company and corporation sold appliances on similar lines and did not rely much on making a profit from them. They allowed for hire purchase popularizing appliances, while making it self-supporting. After all, the sale of gas was the prime object, and the sale of appliances, cash or hire purchase, only a means to this end.

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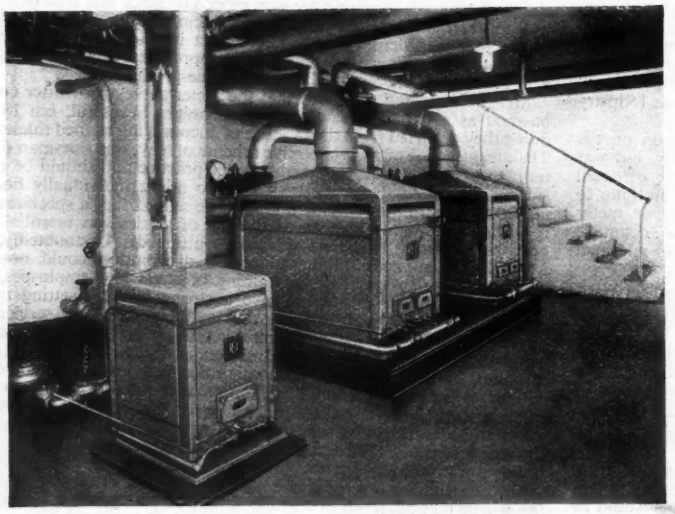

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Gas Products Prices

The London Market Feb. 1.

The chief item of interest in connexion with the Coal Tar Products market is the issue of a new Government Order, the Coal Tar Products Prices Order, 1942 (S. R. & O., 1942, No. 2509), which came into force on Jan. 1.

All Coal Tar Products are in good demand, and Pitch in the London area remains about 45s.

The Provinces Feb. 1.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 1s. 10d., pure, 2s. 5d. (controlled by the Control of Toluene No. 2 Order, July 3, 1941, which fixes the maximum price at which this material may be sold). Naphtha and Xylol controlled by the Coal Tar, Naphtha and Xylol Order, 1942, dated Dec. 7, 1942, and operative from Dec. 21. Carbolic acid, 60's, controlled by the Coal Tar Acids Prices (Inland) Order, 1942, operative from May 1. Naphthalene, controlled by the Naphthalene prices (Inland) Order, 1942, datedApril 15, 1942, and operative from May 1, 1942, £19 to £19 10s.—bags free. Anthracene, controlled by the Anthracene Prices (Inland) Order, 1942, operative from May 1. Filtered heavy oil (min. gr. 1,080), 7½d. to 8d. Creosote oil has been generally controlled as to direction and price for some time past. Current value—fuel grades 5d. to 5¼d.; timber preservation and other purposes 4¾d. to 6d.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Tar Products in Scotland Jan. 30.

Market continues active. Refined tar controlled. Value is 4½d. per gallon *ex* Works, naked. Creosote oil: Specification oil, 6½d. to 7d.; low gravity, 7¼d. to 7½d.; neutral oil, 6d. to 6½d.; hydrogenation oil, 5.875d. per gallon; all *ex* Works in bulk. Refined cresylic acid is in good call at 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha: 6½d. to 7d. per gallon. Solvent naphtha: Basic prices delivered in bulk, 90/160 grade, 2s. 8d., and 90/190 Heavy naphtha, Unrectified, 1s. 10½d.; Rectified, 2s. 3d. per gallon. Pyridine: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

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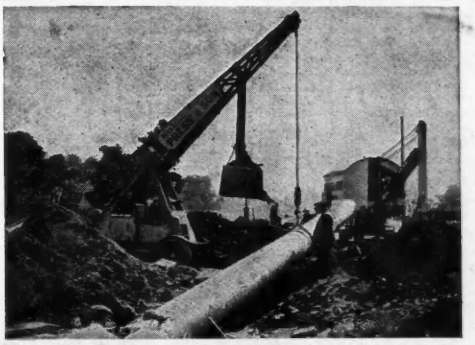

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GAS STOCKS AND SHARES

There were a few good features in the stock markets last week, notably in the industrial and oil sections, although the volume of business generally was on a small scale. The undertone, however, remained quite steady. Similar conditions prevailed in the Gas market, but the smallest parcel of stock changing hands was sufficient to send up the price. During the past month nearly 60 of the issues shown in the tables below have been marked up. Wandsworth ordinary heads the list with a gain of 16 points to 102½ on the increased dividend announcement, the distribution for the past year being 5% against 4% for 1941. Oriental was also a good feature with a gain of 11 points.

The following price changes were recorded during the past week:

SUPPLEMENTARY LIST

Croydon 4 p.c. Pref.	80—85	+2

PROVINCIAL EXCHANGES

Bristol Ord.	108¾—110½	+¾
Newcastle Units	20/9—21/3	+–/6d.

OFFICIAL LIST

Associated Gas & Water Deferred...	17/9—18/9	+–/3d.	
Ditto 4 p.c. Red. Cum. Pref. ...	17/6—18/6	+–/3d.	
British 4 p.c. Red. Deb.	92—97	+7	
Imperial Continental Ord. ...	77—82	–1	
Ditto 3½ p.c. Red. Deb. (x.d.) ...	95—100	Jan. 25	
Montevideo	93—98	+1	
Severn Valley Ord.	18/6—20/6	+–/6d.	
South-Eastern Gas Corporation Ord.	16/9—17/9	––/3d.	
Ditto 4½ p.c. Red Cum. Pref. ...	18/—20/–	+1/–	
Ditto 4 p.c. Pref.	15/6—17/6	+1/–	
South Metropolitan 3 p.c. Deb. ...	80—85	+3	
South Suburban Ord.	88—93	+1	
Ditto 4 p.c. Pref.	84—89	+2	
United Kingdom 4 p.c. 1st Red. Cum. Pref.	18/—20/–	+–/6d.	
Wandsworth Ord. (x.d.)	100—105	Jan. 25	
Ditto 4 p.c. Pref. (x.d.)	83—88	"	

Quotations on the London and Provincial Stock Exchanges

OFFICIAL LIST

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Jan. 28.
1,767,439	Sept. 7	5	5	Alliance & Dublin Ord. ...	110—115
374 000	Dec. 28	4	4	Do. 4 p.c. Deb. ...	98—103
583.407	Nov. 9	5	5	Assed. Gas & Water U'd'es Ord.	17/6—18/6
388,938	"	—	—	Do. Deferred ...	17/9—18/9
500,000	"	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	17/—18/–
536,545	"	4	4	Do. 4 p.c. Red. Cum Pref.	17/6—18/6
341,966	"	4	4	Do. 4 p.c. Irred. Cum. Pref.	14/9—15/9
561,370	Aug. 24	7	7	Barnet Ord. 7 p.c.	135—140
300,000	Oct. 5	1/9⅜	1/4⅜	Bombay, Ltd.	21/6—22/6
690,407	Aug. 17	7	7	Bournemouth 7 p.c.max. ...	137—142
362,025	Dec. 14	4	4	Do. 4 p.c. Deb. ...	97—102
659,955	Sept. 7	2½	2½	Brighton, &c., 5 p.c. Con. ...	74—79
855,000	" 28	6	6	Brit. Gas Light Ord.	88—93
545,000	Dec. 21	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115
120,000	" 14	4	4	Do. 4 p.c. Red. Deb.	92—97
10,000	Nov. 6 '33	6	4	Cape Town, Ltd., 4½ p.c. Cu. Pf.	35/—55/–
626,860	July 13	6	6	Cardiff Con. Ord.	101—106
24,500	Oct. 26	7	7	Colombo 7 p.c. Pref.	20/—22/–
764,169	Sept. 28	–/9.56	–/9.56	Colonial Gas Assn. Ltd. Ord. ...	¼—½
400,000	"	1/3.298	1/3.298	Do. 8 p.c. Pref. ...	¼—½
1,748,935	July 22 '40	2	3	Commercial Ord.	62—67
620,000	Dec. 7	3	3	Do. 3 p.c. Deb.	60—65
286,344	Aug. 17	5	5	Do. 5 p.c. Deb.	100—105
807,560	" 24	6	6	Croydon sliding scale	110—115
644,590	"	5	5	Do. max. div.	87–92
620,385	Dec. 28	5	5	Do. 5 p.c. Perp. Deb. ...	120—125
179,500	Aug. 17	5	5	East Surrey 'B,' 5 p.c.	80—85
176,461	Dec. 28	5 –	5	Do. 5 p.c. Deb. (Irred.)...	115—120
250,000	Nov. 9	6	4	Gas Consolidation Ord. 'B' ...	16/6—17/6
250,000	"	4	4	Do. 4 p.c. Red. Cum. Pref.	18/—20/–
19,107,811	July 29 '40	3⅜	4⅜	Gas Light & Coke Ord. ...	17/—18/–a
2,600,000	"	3½	3½	Do. 3½ p.c. max.	64—67
4,477,106	"	4	4	Do. 4 p.c. Con. Pref. ...	80—85
2,993,000	July 8 '40	3¾	3¾	Do. 3½ p.c. Red. Pref. ...	79—84
8,602,497	June 1	3	3	Do. 3 p.c. Con. Deb. ...	84—87
3,642,770	"	5	5	Do. 5 p.c. Red. Deb. ...	106—109
3,500,000	"	4½	4½	Do. 4½ p.c. Red. Deb. ...	104—108
700,000	Sept. 14	3½	3½	Do. 3½ Red. Deb. ...	92—95
5,600,000	May 13 '40	4	8	Imperial Continental Cap. ...	77—82
43,820	Jan. 25	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100*
231,978	Aug. 24	5	5	M.S. Utility 'C' Cons.	82—87
918,657	"	4	4	4 p.c. Cons. Pref.	82—87
675,000	Nov. 16	†4	†4	Montevideo, Ltd.	93—98
300,000	Dec. 14	7	9	Oriental, Ltd.	96—101
368,537	June 15	3½	2½†	Plymouth & Stonehouse 5 p.c.	67—72
621,667	Aug. 17	7½	7½	Portsmouth & Gosport Cons.	100—105
2,381,363	May 18	—	4†	Primitiva Holdings, Ltd. Ord.	10/6—12/6
233,900	Dec. 14	3½	3½	Do. 6½ p.c. Red. Cum. Pref.	96—101
648,999	Sept. 7	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	18/6—20/6
597,972	"	4½	4½	Do. 4½ p.c. Cum. Pref. ...	16/6—18/6
2,528,714	Aug. 24	1/–	7½	South East'n Gas Cn. Ld. Ord.	16/9—17/9
1,000,000	"	–/10½	–/10½	Do. 4½ p.c. Red. Cum. Pref.	18/—20/–
1,068,869	"	4	4	Do 4 p.c. Irred. Cum. Pref.	15/6—17/6
6,709,895	Aug. 5 '40	4	4	South Met. Ord.	73—78
1,135,812	"	6	6	Do. 6 p.c. Irred. Pref. ...	90—95
850,000	"	4	4	Do. 4 p.c. Irred. Pref. ...	73—78
1,895,445	Dec. 28	3	3	Do. 3 p.c. Perp. Deb. ...	80—85
1,000,000	Jan. 11	5	5	Do. 5 p.c. Red. Deb. ...	102—107
1,543,795	Aug. 4	4	4	South Suburban Ord. 5 p.c ...	88—93
512,825	"	5	5	Do. 5 p.c. Perp. Pref. ...	97—102
500,000	"	4	4	Do. 4 p.c. Perp. Pref. ...	84—89
250,000	"	3½	3½	Do. 3½ p.c. Red. Pref. ...	90—95
888,587	Dec. 14	3	5	Do. 5 p.c. Perp. Deb. ...	120—125
750,541	Aug. 17	2	6	Southampton Ord.	73—78
350,000	"	5½	5½	Swansea 5½ p.c. Red. Pref. ...	95—100
1,076,495	"	5	5	Tottenham & District Ord. ...	97—102
338,555	"	5	5	Do. 5 p.c. Pref.	97—102
453,380	Dec. 7	4	4	Do. 4 p.c. Perp. Deb. ...	97—102
1,247,505	Nov. 9	6	4	U. Kingdom Gas Cor. Ord. ...	18/9—19/9
1,085,952	Nov. 16	4½	4½	Do. 4½ p.c. 1st Cum. Pref. ...	18/—20/–
772,709	"	4	4	Do. 4 p.c. 1st Red. Cum.Pref.	18/—20/–
745,263	Dec. 14	4½	4½	Do. 4½ p.c. 2nd Non.Cum. Pf.	14/6—16/6
1,200,000	Sept. 14	3½	3½	Do. 3½ p.c. Red. Deb. ...	92—97
380,606	Aug. 24	6½	6½	Uxbridge, &c., 5 p.c.	113—118
1,371,138	Jan. 25	4	6	Wandsworth Consolidated ...	100—105*
2,525,768	"	4	4	Do. 4 p.c. Pref.	83—88*
1,343,964	Dec. 14	5	5	Do. 5 p.c. Deb.	120—125
383,745	"	4	4	Do. 4 p.c. Deb.	95—100
568,342	Aug. 10	5	5	Watford & St. Albans Ord. ...	100 —105
300,000	Dec. 7	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95

SUPPLEMENTARY LIST

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Jan. 28.
351,685	Dec. 14	5	5	Brighton, &c., 5 p.c. Perp. Deb.	115—120
415,250	"	4	4	Bristol Gas Co., 4 p.c. New Deb.	97—102
140,205	Aug. 4	7	7	Cambridge, &c., 7 p.c. Cons. 'B'	130—135
295,932	Aug. 17	5	5	Cheltenham, 5 p.c. Cons. Ord....	95—100
42,500	Dec. 14	4	4	Do. 4 p.c. Perp. Deb....	95—100
150,000	Aug. 24	4	4	Croydon Gas, 4 p.c. Pref. (Irr.)	80—85
130,000	Dec. 28	4	4	Do. 4 p.c. Deb. ...	97—102
146,700	Aug. 17	5½	5½	East Surrey, 5½ p.c. Pref. 'A' ...	95—100
53,220	" 9	6	6	Do. 6 p.c. Cum. Pref. ...	115—120
...	Aug. 19 '40	6	4	Eastbourne, 'B' 3½ p.c.... ...	42—47
117,425	Feb. 5 '40	8	8	East Wight Cons. 5 p.c. ...	65—70
239,135	Nov. 9	5	5	Gas Consolidation 'A' Ord. (£1)	15–/–17/–
156,600	Aug. 17	5	5	Hampton C't, 5 p.c. Cons. Ord.	95—100
18,000	Dec. 29'41	3½	3½	Malta & Med'n., 7 p.c. 1st Pref.	30—40
10,845	June 30'41	3½	3½	Do. 7½ p.c. 2nd Pref.	30—40
50,000	Aug. 24	£5 4 6	£5 4 6	Mid. South. Util., 'A' Cons. 5 p.c.	70—80
65,000	"	5	5	North Middlesex, 5 p.c. Pref....	95—100
70,000	Sept. 14	5	5	Plymouth & Stone., 5 p.c. Deb.	107—112
76,501	Dec. 21	4	4	Reading, 4 p.c. Perp. Deb. ...	95—100
74,777	Sept. 30	4	4	Romford, 4 p.c. Debs. (Reg.) ...	95—100
21,000	Dec. 7	5	5	Slough, 5 p.c. Perp. Deb. ...	110—115
211,740	" 14	5	5	Southampton, 5 p.c. Red. Deb.	95—100
363,575	Jan. 4	5	5	Tottenham, 5 p.c. Reg. Red. Mt.	99—102*
202,019	Aug. 24	7⅜	7⅜	Tunbridge Wells, 4 p.c. Scale ...	119—124
135,257	June 15	5	5	Uxbridge &c., 5 p.c. Perp. Deb.	115—120

PROVINCIAL EXCHANGES

					Quotations Jan.. 22.
804,948	Sept. 28	5	5	Bath Cons.	97—100
122,577	Aug. 17	6	5	Blyth 5 p.c. Ord.	100—105
1,667,250	July 13	5	5	Bristol, 5 p.c. max.	108¾—110½
120,420	Dec. 14	4	4	Do. 1st 4 p.c. Deb.	101—103
415,250	"	4	4	Do. 2nd 4 p.c. Deb.	99—101
328,790	"	5	5	Do. 5 p.c. Deb.	112—117
157,150	Aug. 4	6½	5	Chester 5 p.c. Ord.	100—102
92,500	Dec. 14	4	4	Do. 4 p.c. Pref.	79—81
36,430	"	3½	3½	Do. 3½ p.c. Deb.	78—82
41,890	"	4	4	Do. 4 p.c. Red. Deb. ...	98—100
542,270	Aug. 17	9	6	Derby Cons.	115—120
55,000	June 21	4	4	Do. 4 p.c. Deb.	95—100
10,000	Aug. 10	10	10	Great Grimsby 'A' Ord. ...	155—165
6,500	"	10	10	Do. 'B' Ord. ...	155—165
79,000	"	10	10	Do. 'C' Ord. ...	145—155
732,000	Aug. 31	4	4	Hartlepool G. & W. Cn. & New	73—74
2,167,410	" 10	6	5	Liverpool 5 p.c. Ord.	102—104
245,500	Dec. 21	5	5	Do. 5 p.c. Red. Pref. ...	99—101
306,083	July 15	4	4	Do. 4 p.c. Deb.	100—102
20,000	June 22	5	5	Long Eaton 5 p.c. Pref.	9—11
80,000	"	5	5	Do. 5 p.c. Deb.	95—100
2,430,267	Aug. 4	5½	5	Newcastle and Gateshead Con.	20/9—21/3
682,856	"	4	4	Do. 4 p.c. Pref.	94½—95½
776,706	Dec. 28	3½	3½	Do. 3½ p.c. Deb.	93½—94½
277,285	Nov. 2	5	5	Do. 5 p.c. Deb. '43 ...	99—101
274,000	March 17	5	5	Newport (Mon.) Ord.	86—89
13,200	Sept. 16	8⅝	7	Pontyp'l Gas & W. 10 p.c. 'A'	11½—12½
13,600	"	6	5	Do. 7 p.c. 'B'	9½—10½
40,000	"	5	6	Do. 7 p.c. 'C'	9½—10½
106,280	Aug. 10	10	10	Preston 'A' 10 p.c.	150—160
188,219	"	7	7	Do. 'B' 7 p.c.	109—119
1,806,339	Aug. 24	6½	6½	Sheffield Cons.	129—132
95,000	Jan. 4	4	4	Do. 4 p.c. Deb.	98—100
332,351	Sept. 21	6	6	Sunderland 6 p.c. max. ...	112—113
192,150	Aug. 10	5	5	Weston-super-Mare Cons. ...	95—100
64,338	Jan. 4	4	4	Do. 4 p.c. Deb.	94—99
33,340	"	7½	7½	Do. 7½ p.c. Deb.	142—147

a—The quotation is per £1 of Stock. * Ex. div. † Paid free of income-tax. ‡For year.